



Perchlorate from GW Pumping Las Vegas Wash Construction

January 11, 2016

Zachary Hills P.E.



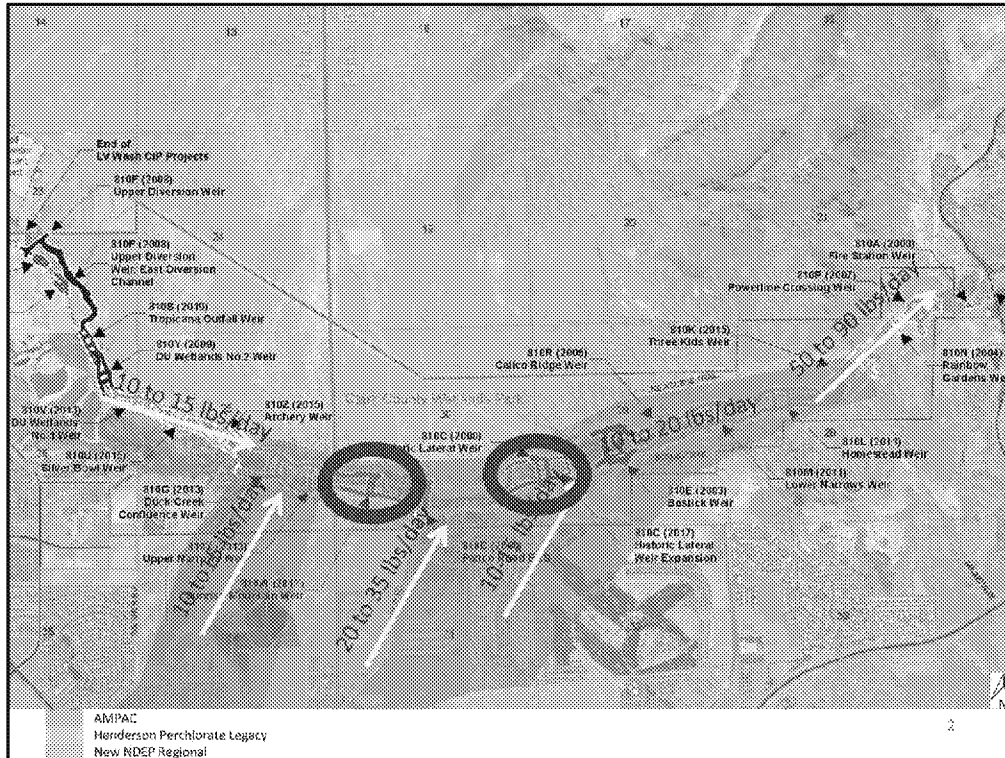
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A total of 19 erosion control structures (Weirs) have been construction along the Las Vegas Wash over the course of the last 15-years. One of the critical components of construction includes excavating the foundation of the structures. When excavation is completed, groundwater is encountered, that must be evacuated for constructability purposes; pumped groundwater is permitted by the NDEP.

This presentation provides a **history** of **groundwater pumping** associated with construction of erosion control structures along the Las Vegas Wash.

Perchlorate (CLO₄) is the constituent of interest and the range of data that will be provided comprises years 2004 through early 2015.

The **objective** of this presentation/discussion is to use historical perchlorate (CLO₄) concentrations along the Las Vegas Wash to project (anticipate) concentrations associated with groundwater pumping for the construction of the Sunrise Mountain and Historic Lateral Weirs.

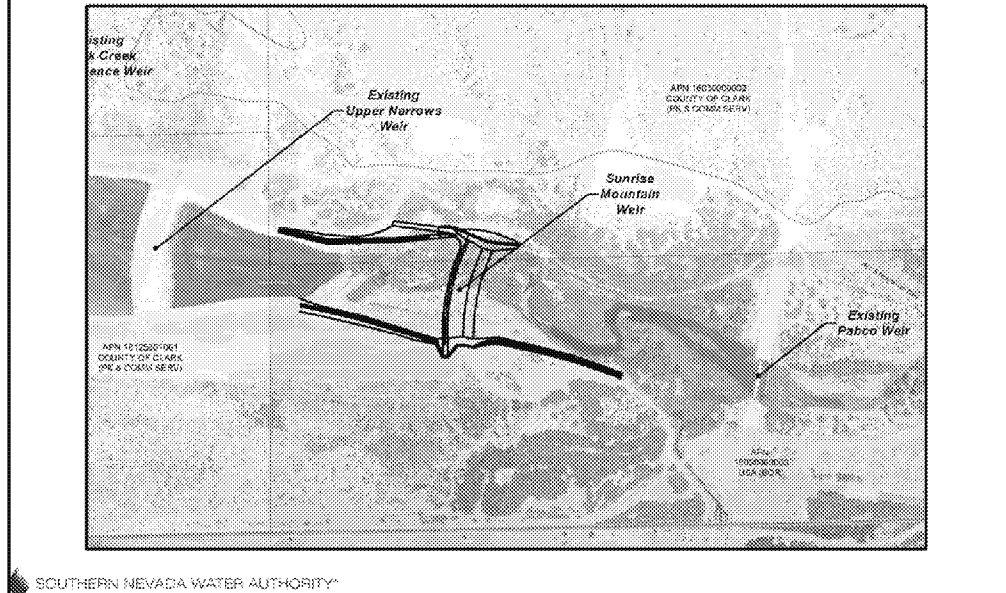


This map provides approximate limits of GW contamination with estimated loading rates within the vicinity of the Las Vegas Wash, according to NDEP. Perchlorate (CLO4) is the constituent of interest and the range of data that will be provided comprises years 2004 through early 2015.

Ref: SNWA 2015 Las Vegas Wash CIP Grade Control Structures 2015 Map

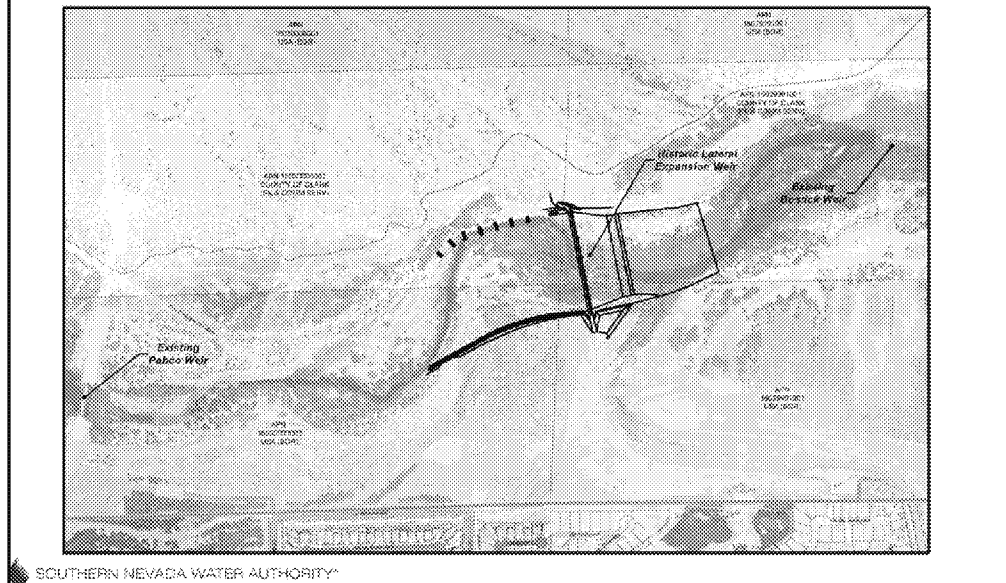
Ref: "NERT Site Regional Area – Existing and Proposed Remediation Infrastructure" and "Perchlorate Concentration Estimate" provided by NERT/NDEP tour 1/27/2015

Land Ownership Sunrise Mountain Weir (SRM)



Sunrise Mountain Weir is split between Clark County and Bureau of Reclamation lands

Land Ownership Historic Lateral Weir (HL)



Historic Lateral Weir is split between Clark County and Bureau of Reclamation lands

Scope (SRM & HL)

- **Vegetation Clearing** – mostly complete early 2015
- **Two Weir Structures** (14-ft of vertical drop)
- **Over 3,700-lf of Bank Protection**
- **Temporary Diversions**



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Weir Structures (SRM & HL)

Technical drawing of a weir structure, showing SRM (Solid Rock Masonry) and HL (Heavy Riprap) sections. The drawing includes dimensions, elevations, and material specifications.

Dimensions:

- Horizontal dimensions: 52.0', 24.0', 206.0', 89.0'
- Vertical dimensions: 4-ft & 10-ft, 50-ft

Elevations:

- SRM: EL. 1518.0, EL. 1518.15H, EL. 1501, EL. 1500, EL. 1502
- HL: EL. 1502, EL. 1500, EL. 1498

Structural Details:

- 20:1 chute
- concrete capped steel sheet pile
- EX TSP VARIES (1512-1500)
- HEAVY RIPRAP
- 20:1
- D50 = 36" & 42" flexible rip rap
- EX BSP VARIES (1502-1510)
- EX BSH 2
- EX BSH 1

Notes:

- NOTE 1: REMOVE ABANDONED EX TSPW 90° TO NORTH LINE AND COATED STEEL LVL. PIPE PER NOTE 4
- NOTE 2: SHEET PILE
- NOTE 3: EL. 1498 BSP
- NOTE 4: EL. 1501, EL. 1500, EL. 1498

Other Labels:

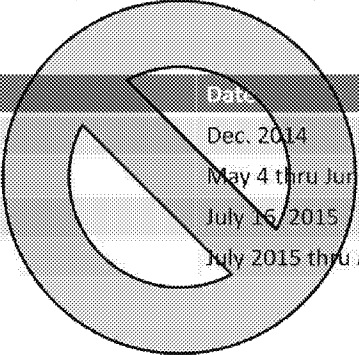
- ADRIEL L. 1518
- EL. 1518.0
- EL. 1518.15H
- EL. 1501
- EL. 1500
- EL. 1502
- EL. 1502
- EL. 1500
- EL. 1498

Scale: 1" = 10'

Source: SOUTHERN NEVADA WATER AUTHORITY

Sacrificial apron is 4-ft thick and D50=24-in

Schedule & Cost Estimate (SRM & HL)



Milestone	Date
Approvals	Dec. 2014
Bidding Period	May 4 thru June 10, 2015
SNWA Board Approval	July 16, 2015
Construction	July 2015 thru Aug. 2017

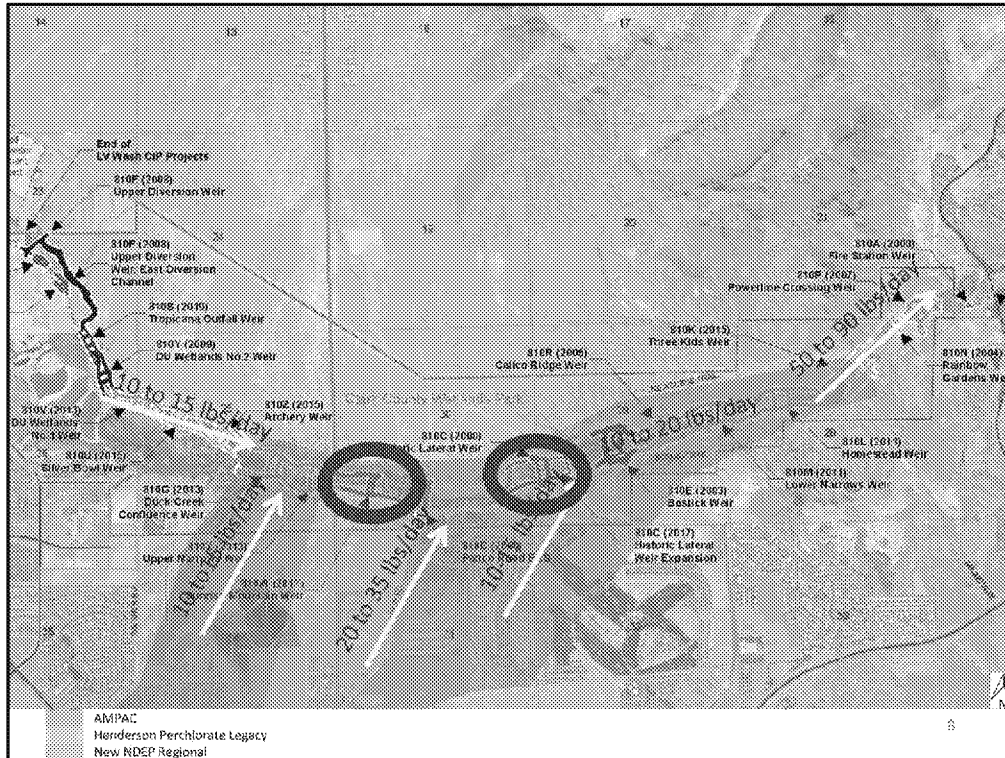
Construction Cost Estimate:
? \$13.7 million ?

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The original schedule has been deferred indefinitely; however, almost 800-calendar days were allocated for Contractor to construct Weirs. This is an abnormally long construction duration for this type of work. The extended schedule timeframe is to account for potential delays due to scaling back GW pumping with the potential for encountering high CLO4 concentrations (meet permit loading requirements).

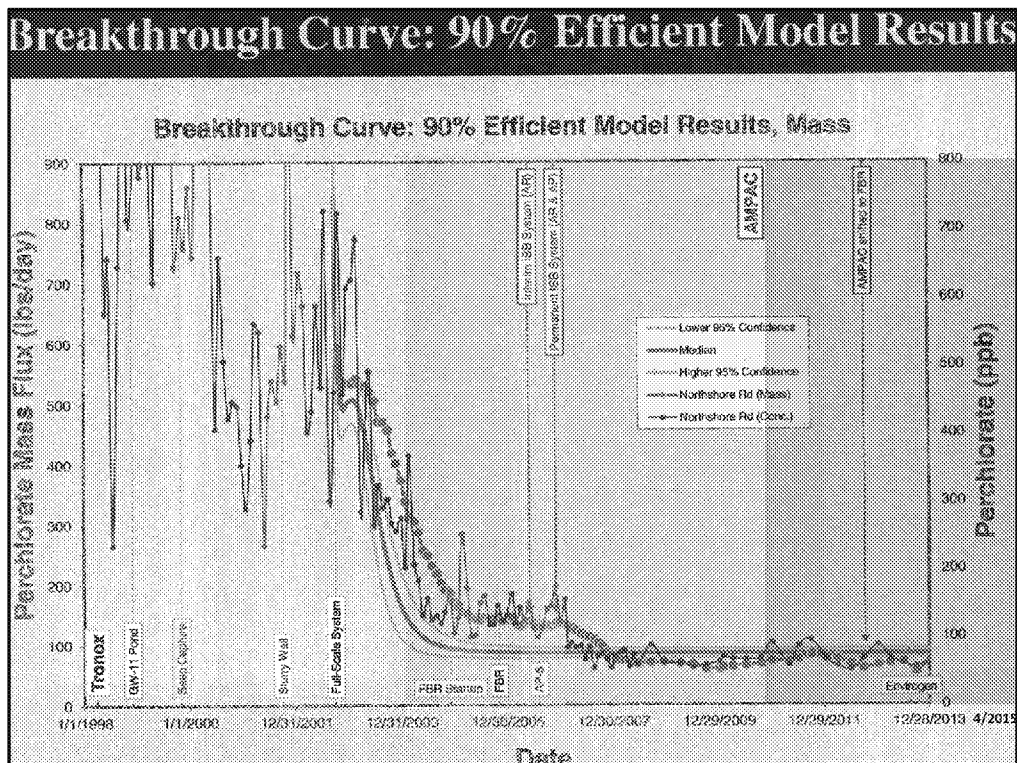
The construction cost estimate may become obsolete, should the project become delayed for an extended amount of time.



This map provides approximate limits of GW contamination with estimated loading rates within the vicinity of the Las Vegas Wash, according to NDEP. Perchlorate (CLO4) is the constituent of interest and the range of data that will be provided comprises years 2004 through early 2015.

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Over the course of the last almost 20 years, loading at Northshore Rd has decreased substantially, as a result of a multiplicity of mitigation measures, some of which includes the following:

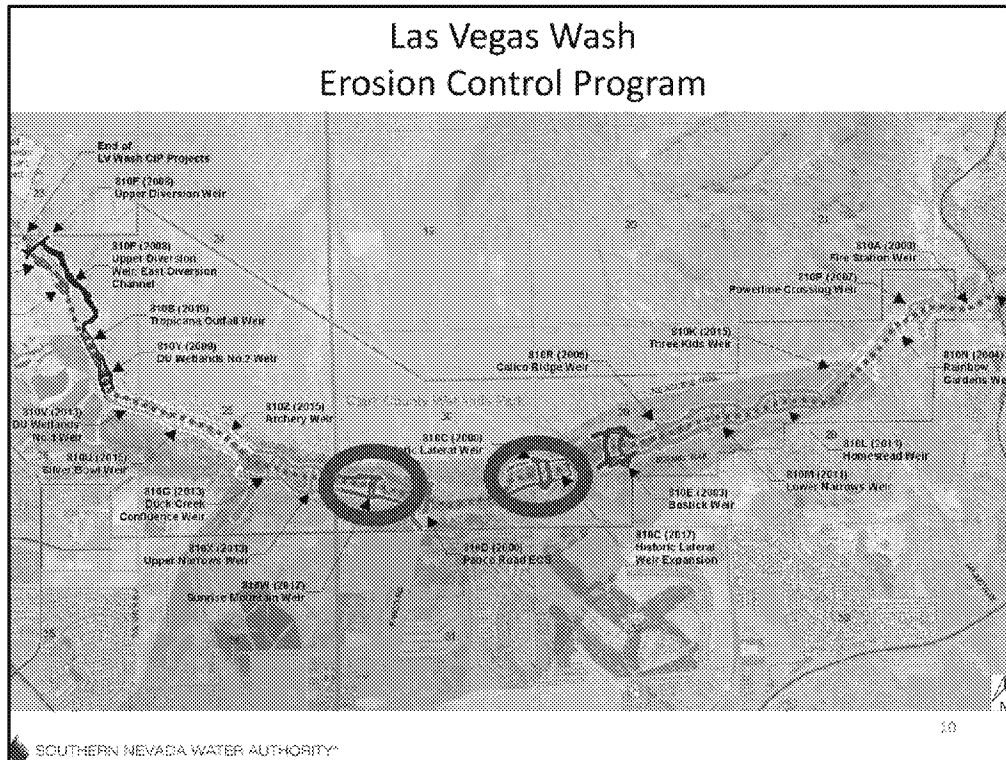
- ~year 2000 - seep capture
- ~year 2001 - slurry wall
- ~year 2004 - Fluidized Bed Reactor (FBR)
- ~year 2005 - In-Situ Bioremediation System (ISB)

Since the year 2007, and in accordance with the provided data, CLO₄ loading at the Northshore Rd has abated substantially to around 80-lbs/day; hopefully the curve does not stabilize at ~80-lbs/day, rather continues in an asymptotic trend, as loading approaches zero.

Most of the data I will be providing contains results of pumping from the last 5 years; however, I have good data that will be provided that dates back to the year 2004. Some of the sites are upstream of the plume, while most of the data is either where the plume reaches the Wash, and downstream.

Gerry Hester indicated when the Pabco Weir was under construction, around the turn of the century timeframe (~2000), 5,700 ppb was encountered.

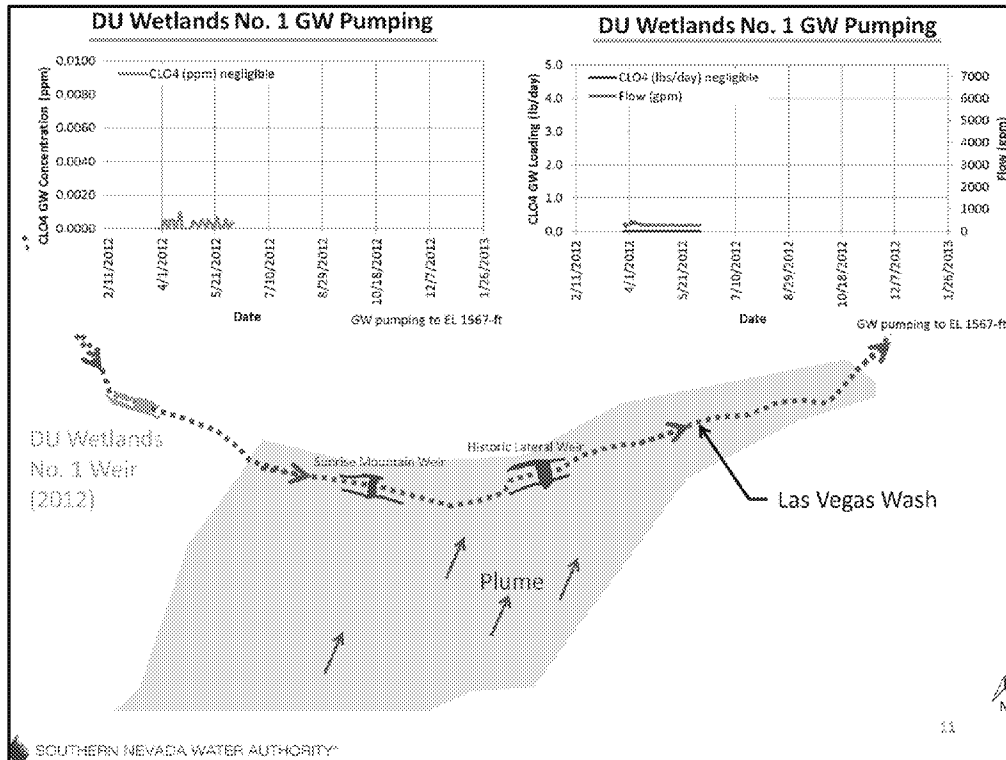
Ref: "NERT Site Regional Area – Existing and Proposed Remediation Infrastructure" and "Perchlorate Concentration Estimate" provided by NERT/NDEP tour 1/27/2015



This map shows the overall LV Wash Erosion Control Program. Highlighted in purple depict the two weirs that are on hold, in anticipation of studies that will dictate whether or not NDEP and NERT will **partner** with SNWA to use weirs as multi-function facilities; to provide both **channel erosion control stabilization** and **perchlorate monitoring and/or treatment**. Again shown in light grey is the expected area of groundwater contamination influence. I would like to take an iterative approach and begin upstream of the groundwater contamination study area (plume).

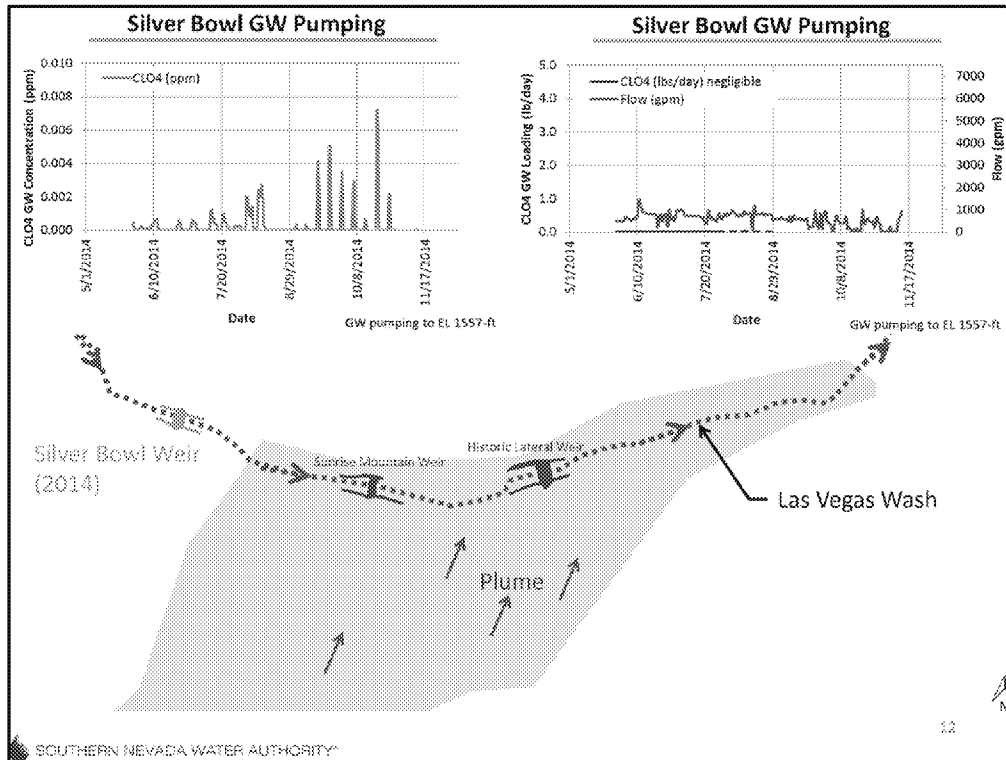
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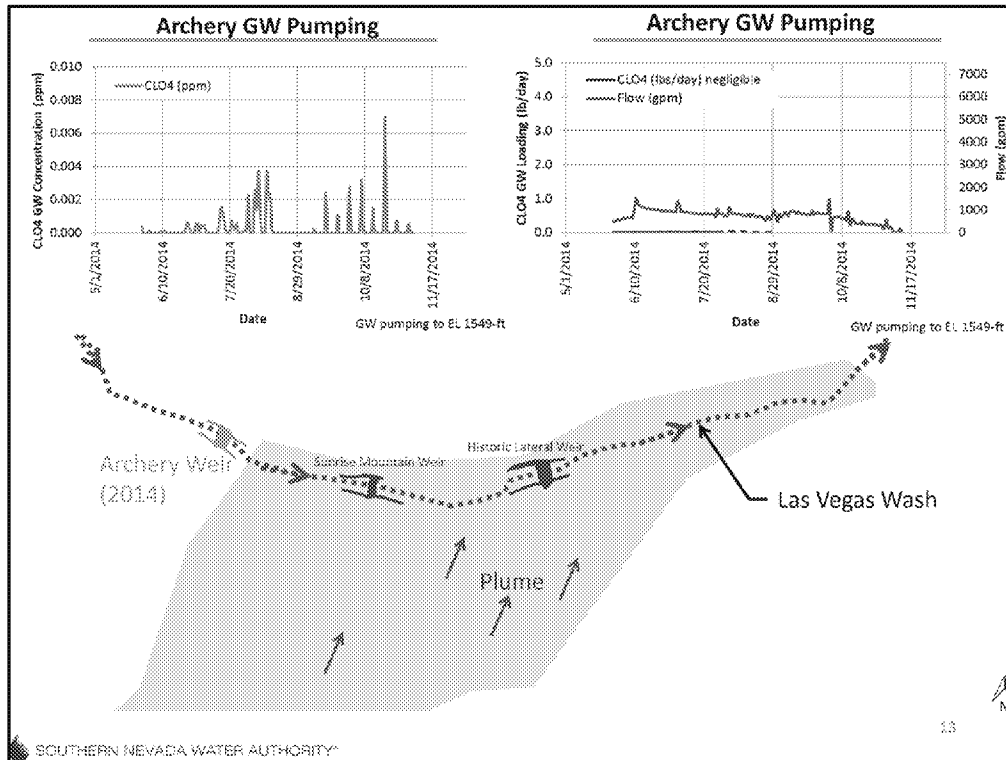


This slide shows the DU Wetlands No. 1 Weir (upstream of the plume). We pumped GW from late March 2012 thru the first part of June 2012 to a groundwater elevation of approx. 1567-ft. CLO4 concentrations (green) were for the most part negligible. Pumping rates (blue) were very low in the order of 280-gpm. This corresponds to a low loading rate (red) – median rate of less than 1/1000 of a pound per day.

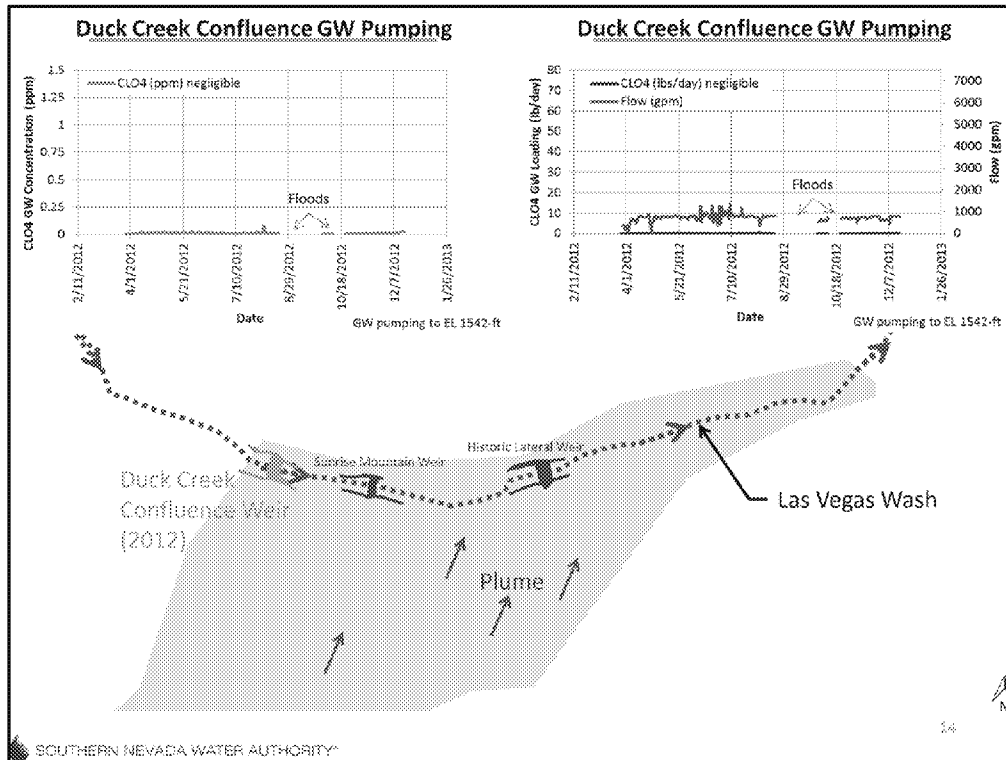
Note: Fixed scales of graphs upstream/outside of plume – max y values of 0.01 and 5. Will adjust scales once enter plume.



This slide shows the Silver Bowl Weir (upstream of the plume).
 We pumped GW from May 2014 thru part of Nov 2014 to a groundwater elevation of approx. 1557-ft.
 CLO4 concentrations (green) were for the most part negligible
 Pumping rates (blue) were very low in the order of 630-gpm
 This corresponds to a low loading rate (red) – median rate of less than 1/1000 of a pound per day.



This slide shows the Archery Weir (upstream of the plume).
 We pumped GW from May 2014 thru part of Nov 2014 to a groundwater elevation of approx. 1549-ft.
 CLO4 concentrations (green) were for the most part negligible
 Pumping rates (blue) were very low in the order of 809-gpm
 This corresponds to a low loading rate (red) – median rate of less than 1/1000 of a pound per day.



This slide shows the Duck Creek Confluence Weir (shown on the fringe of the plume). We pumped GW from March 2012 thru part of Dec 2012 to a groundwater elevation of approx. 1542-ft.

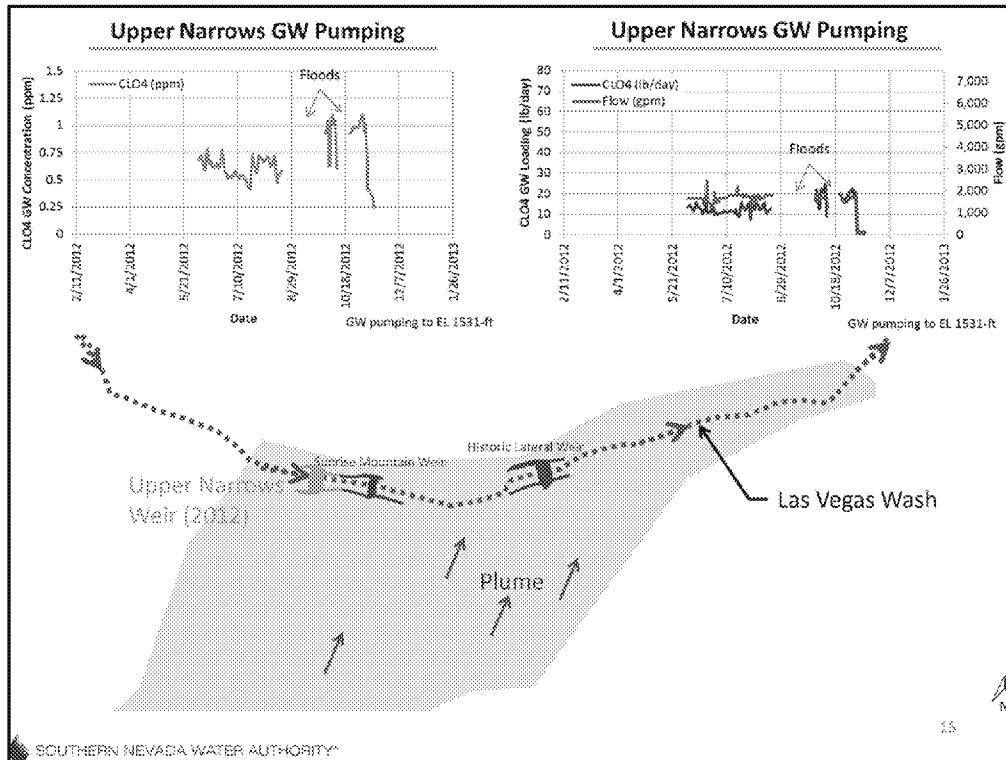
CLO4 concentrations (green) were for the most part negligible

Pumping rates (blue) were very low in the order of 750-gpm

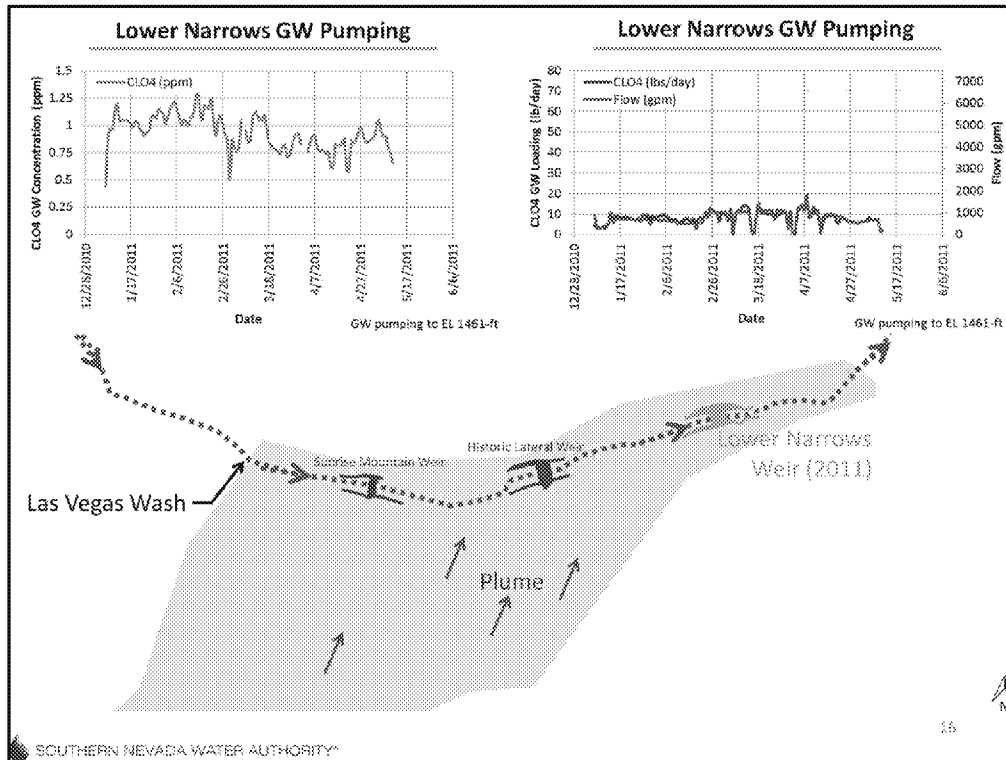
This corresponds to a low loading rate (red) – median rate of less than 13/100 of a pound per day.

Although the Duck Creek Confluence Weir is shown to be within the plume, our GW pumping did not demonstrate influence of CLO4.

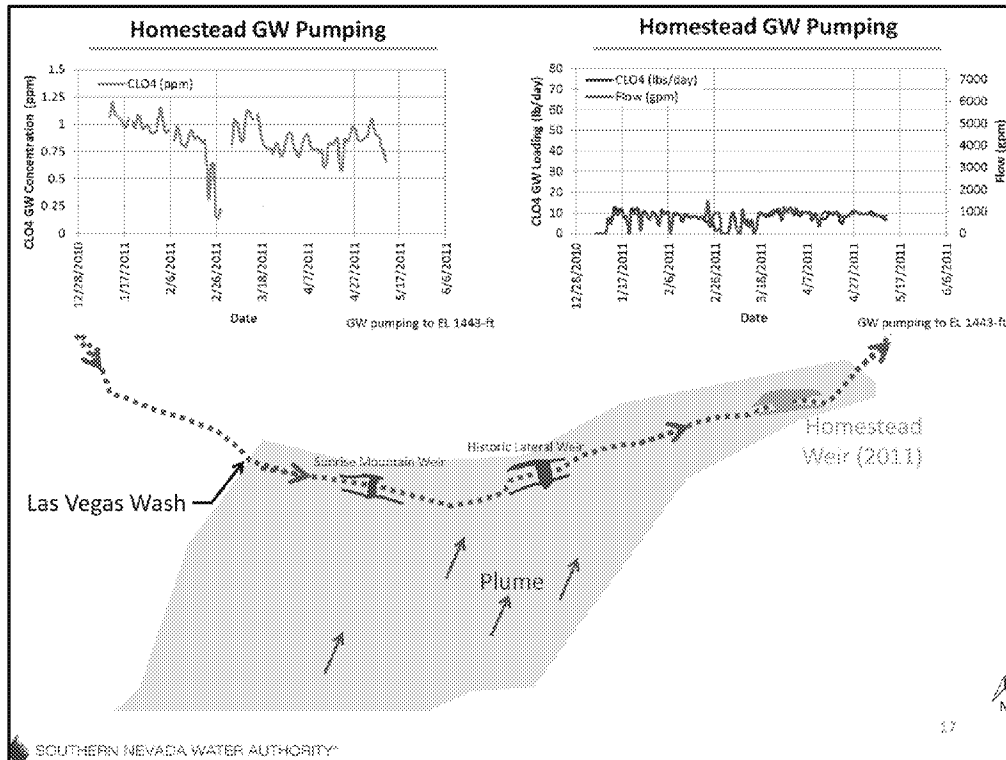
Note: Adjusted scales for structures within plume...went from max y values of .01 and 5 to 1.5 and 80 (rather substantial jump).



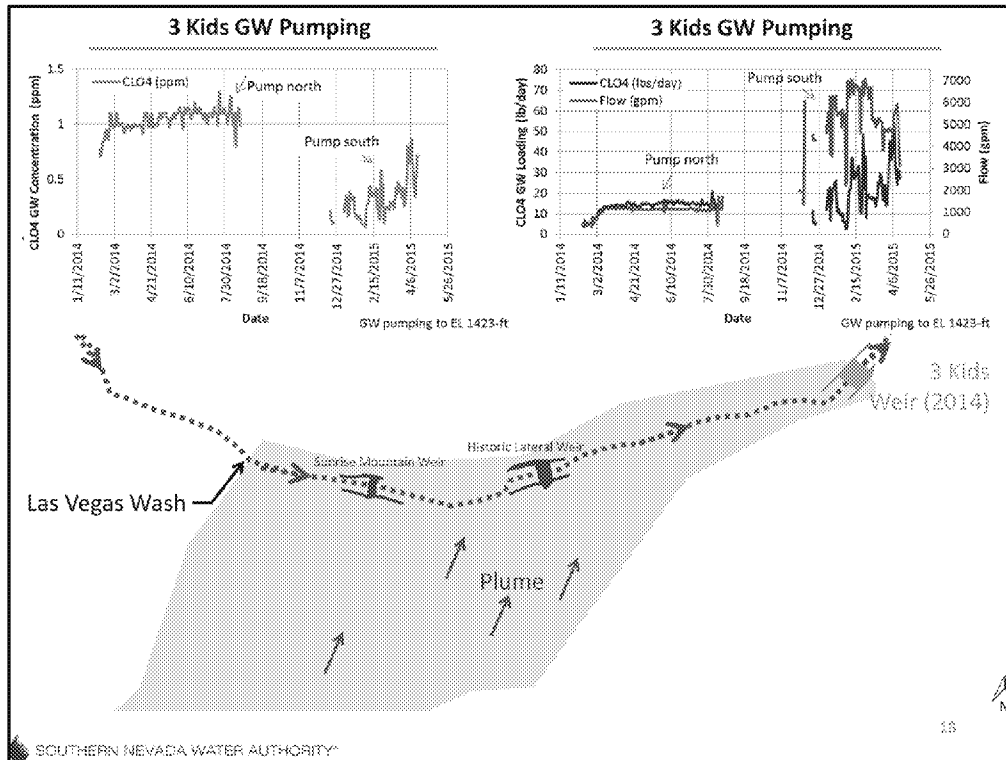
This slide shows the Upper Narrows Weir (shown within the plume).
 We pumped GW from June 2012 thru part of Nov. 2012 to a groundwater elevation of approx. 1531-ft.
 CLO4 concentrations (green) were generally less than 0.7 ppm
 Pumping rates (blue) were in the order of 1670-gpm
 This corresponds to a loading rate (red) – median rate of less than 13 pounds per day.
 The Upper Narrows Weir is the first structure we show that is influenced from the plume.



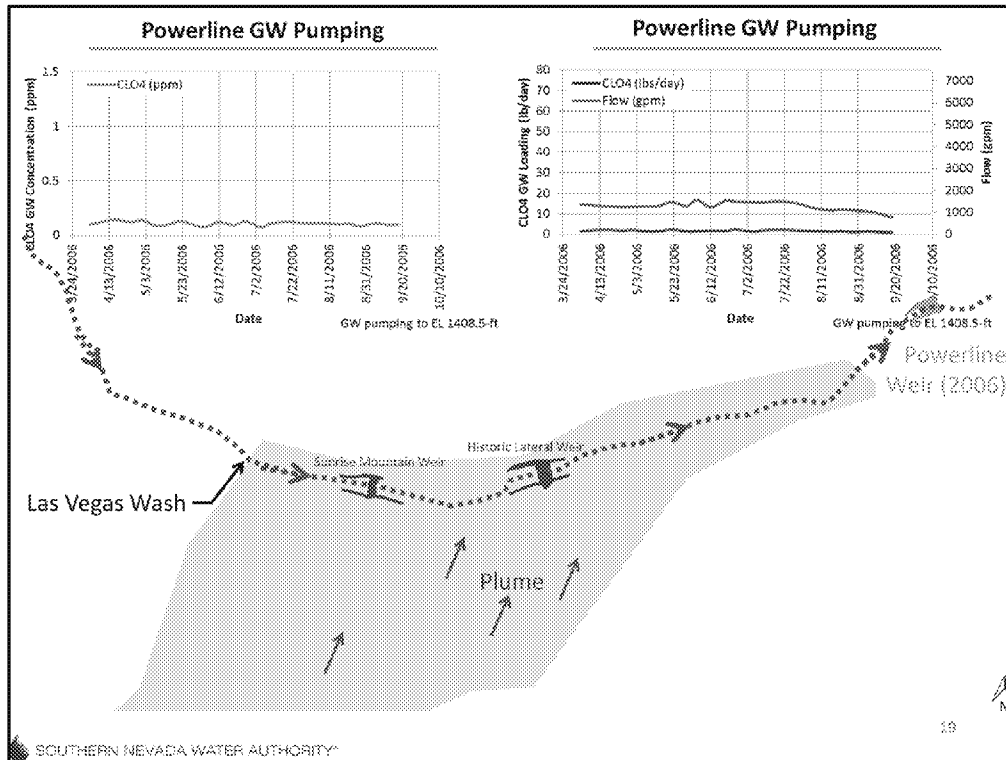
This slide shows the Lower Narrows Weir (shown within the plume).
 We pumped GW from Jan. 2011 thru part of May 2011 to a groundwater elevation of approx. 1461-ft.
 CLO4 concentrations (green) were generally less than 1.0 ppm
 Pumping rates (blue) were in the order of 700-gpm
 This corresponds to a loading rate (red) – median rate of less than 8.5 pounds per day.



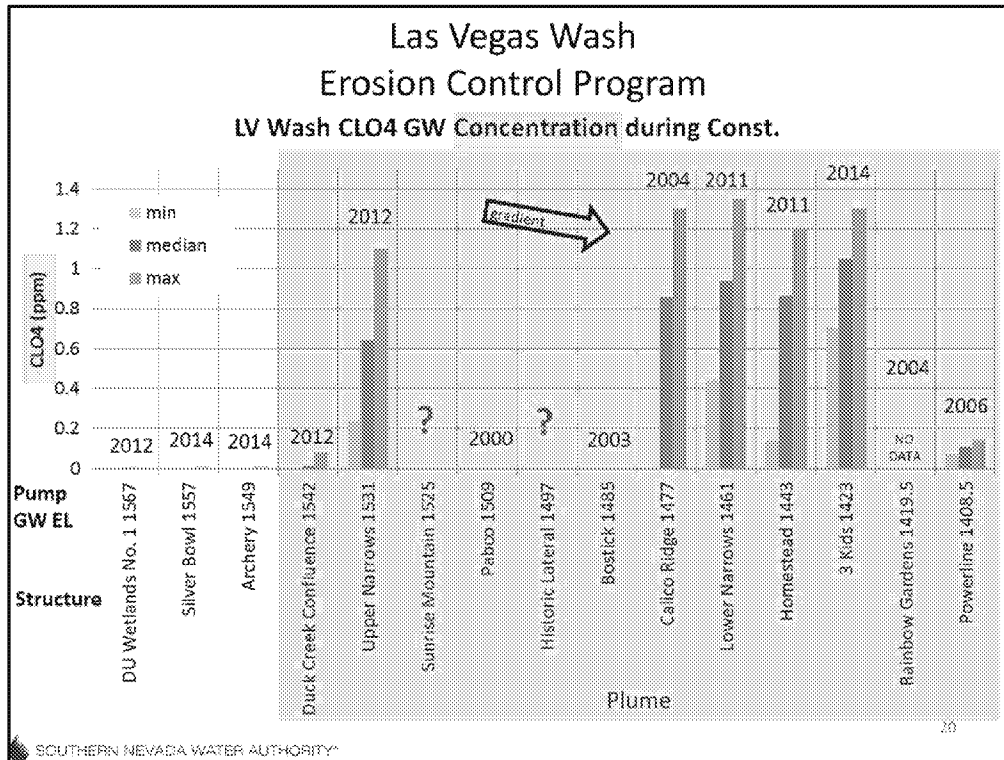
This slide shows the Homestead Weir (shown within the plume).
 We pumped GW from Jan. 2011 thru part of May 2011 to a groundwater elevation of approx. 1443-ft.
 CLO4 concentrations (green) were generally less than 1.0 ppm
 Pumping rates (blue) were in the order of 850-gpm
 This corresponds to a loading rate (red) – median rate of less than 9 pounds per day.



This slide shows the Three Kids Weir (shown within the plume).
 We pumped GW from Feb. 2014 thru part of Apr. 2015 to a groundwater elevation of approx. 1423-ft.
 CLO4 concentrations (green) were generally less than 1.0 ppm
 Pumping rates (blue) were in the order of 1,200-gpm, but as high as permit limits.
 This corresponds to a loading rate (red) – median rate of less than 15 pounds per day.

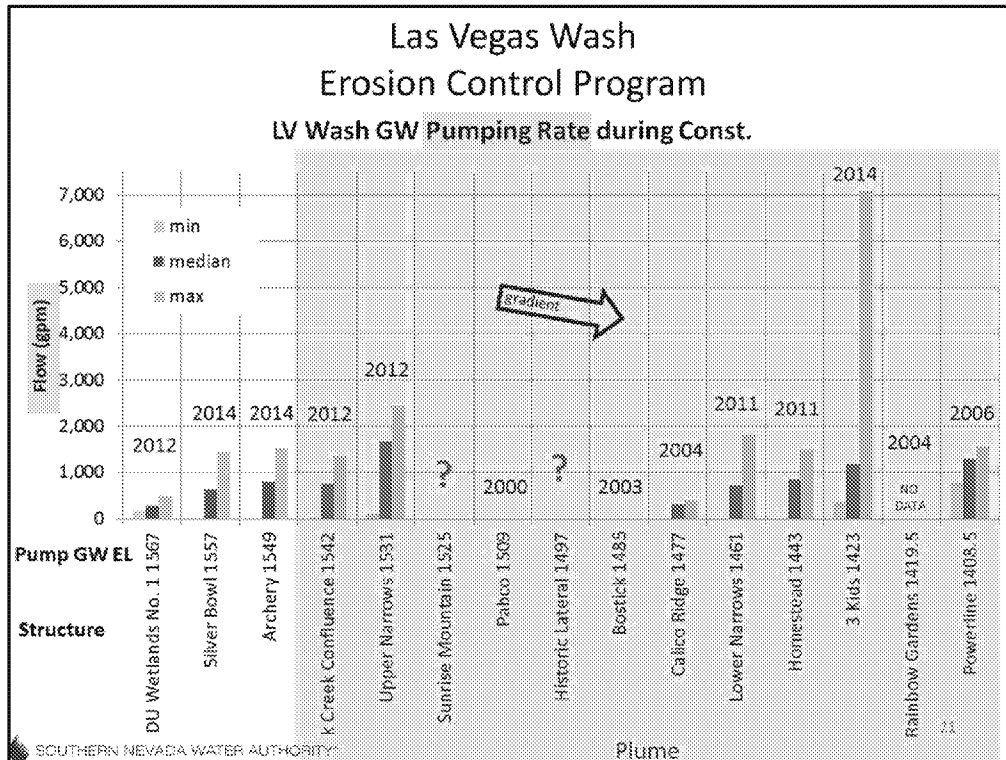


This slide shows the Powerline Weir (shown downstream of the plume).
 We pumped GW from Apr. 2006 thru part of Sept. 2006 to a groundwater elevation of approx. 1408.5-ft.
 CLO4 concentrations (green) were generally less than 1/10th of a ppm
 Pumping rates (blue) were in the order of 1,300-gpm
 This corresponds to a loading rate (red) – median rate of less than 2 pounds per day.



This graphic shows the previously discussed structures from a CLO4 concentration (ppm) standpoint.

As you move from left to right on the x-axis, you move down gradient. As you can see, the Sunrise Mountain and Historic Lateral Weirs are well within the plume; median upstream and downstream structures show concentrations ranging from about 0.6 ppm up to around 1.0 ppm.

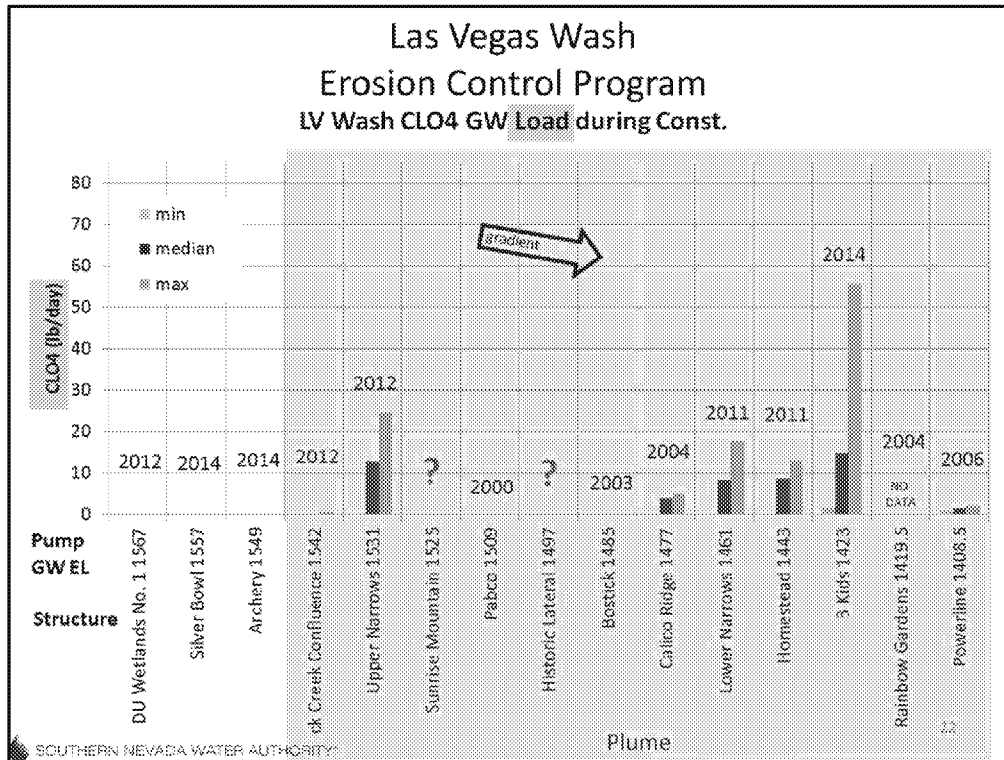


This graphic shows the previously discussed structures from a GW pumping rate (gpm) standpoint.

As you move from left to right on the x-axis, you move down gradient.

Median pumping rates range from a couple hundred gpm up to around 1,500-gpm, but as high as the permit limit of 6,900-gpm.

GW pumping rates may be influenced by not only water bearing geologic features that are intercepted by excavation, but also Contractor means and methods.



This graphic shows the previously discussed structures from a CLO4 loading rate (ppm) standpoint.

As you move from left to right on the x-axis, you move down gradient. As you can see, the Sunrise Mountain and Historic Lateral Weirs are well within the plume; median upstream and downstream structures show loading ranging from about 4-lbs/day up to around 15-lbs/day.

CLO4 loading rates (lbs/day) are a function of water flow and CLO4 concentration.

As mentioned, GW pumping rates may be influenced by not only water bearing geologic features that are intercepted by excavation, but also Contractor means and methods.

CLO4 concentration is a function of not only pumping rates, but also CLO4 concentrations.

Best Guess Range

Concentration

0.6 - 1.0 ppm

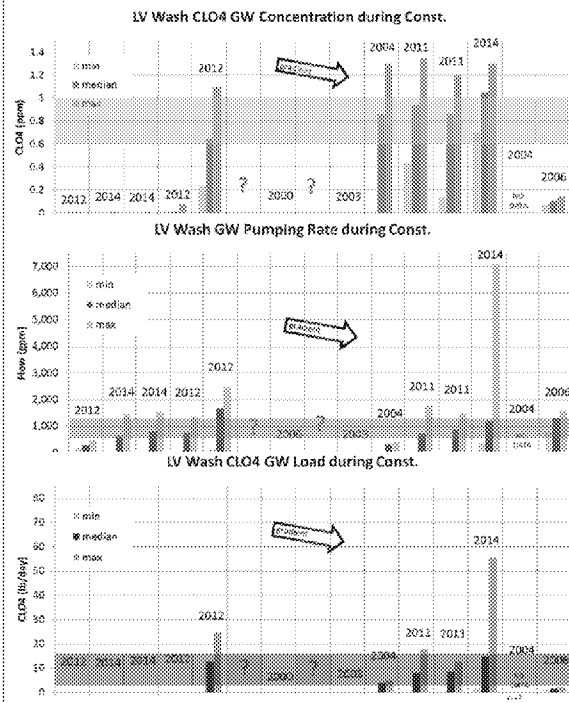
Pumping Rate

500 - 1,250-gpm

Loading

3.6 - 15 lbs/day

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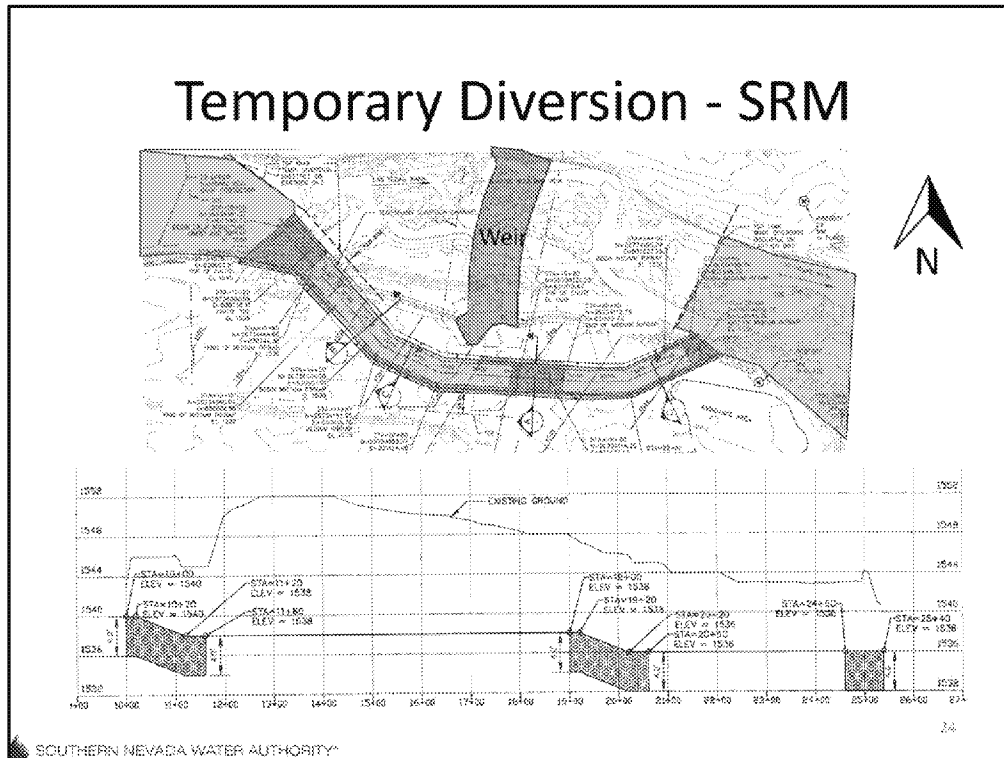


Best Guess Range

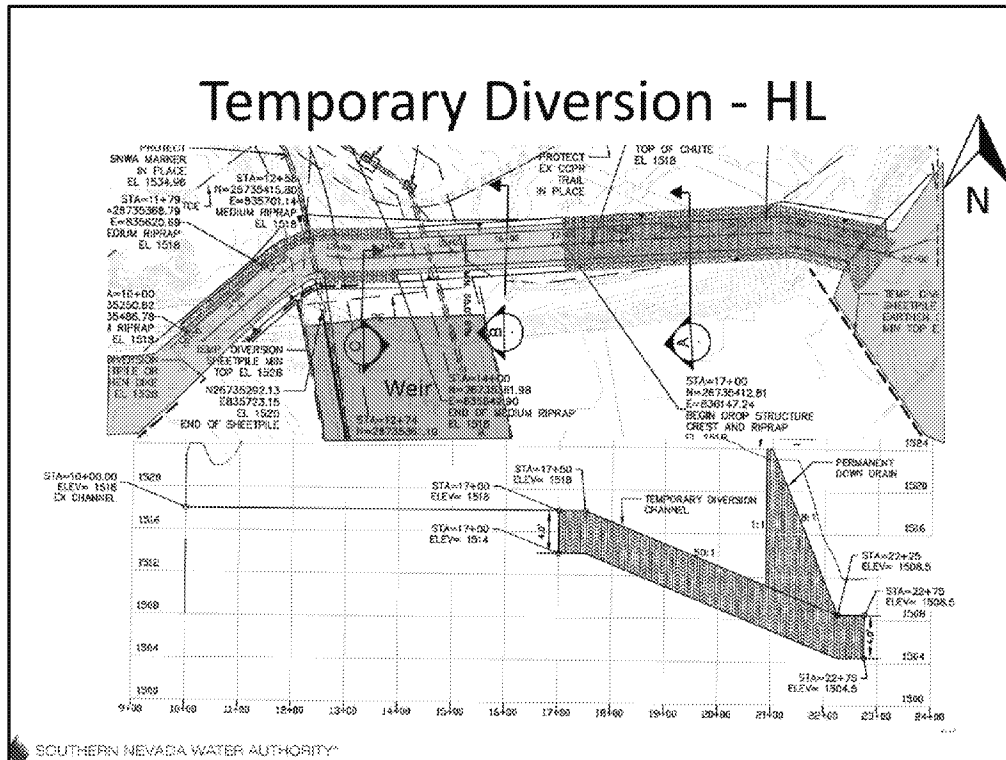
Pumping 500 to 1,250-gpm of

0.6 to 1.0-ppm CLO4

corresponds to 3.6 to 15-lbs/day



The temporary diversion channel associated with the Sunrise Mountain Weir has been designed on the south side of the Las Vegas Wash, in an attempt to intercept the GW plume and act as a GW barrier, for when Contractor conducts structure foundation excavation and corresponding GW pumping.

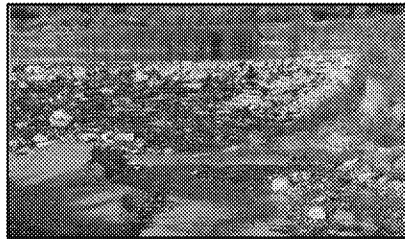


The temporary diversion channel associated with the Historic Lateral Weir has been designed on the north side of the Las Vegas Wash; unfortunately, it was not feasible to place diversion channel on the south side of the Las Vegas Wash.

Again, although we have provide a best guess estimate of what we may encounter during construction, from a pumping rate, concentration and corresponding loading (lbs/day), there is uncertainty associated with the nature of Weir construction at the LV Wash, ie flooding, contractor means and methods, evolution of potential changing permitting, etc. requirements,

Moving Forward...

- NDEP/NERT/SNWA partnering
- monitor and/or remove CLO4 from SRM and/or HL Weirs?
- Questions and discussions...



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Defer to Dave Johnson for partnering opportunities between SNWA, NDEP and NERT.



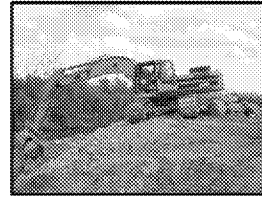
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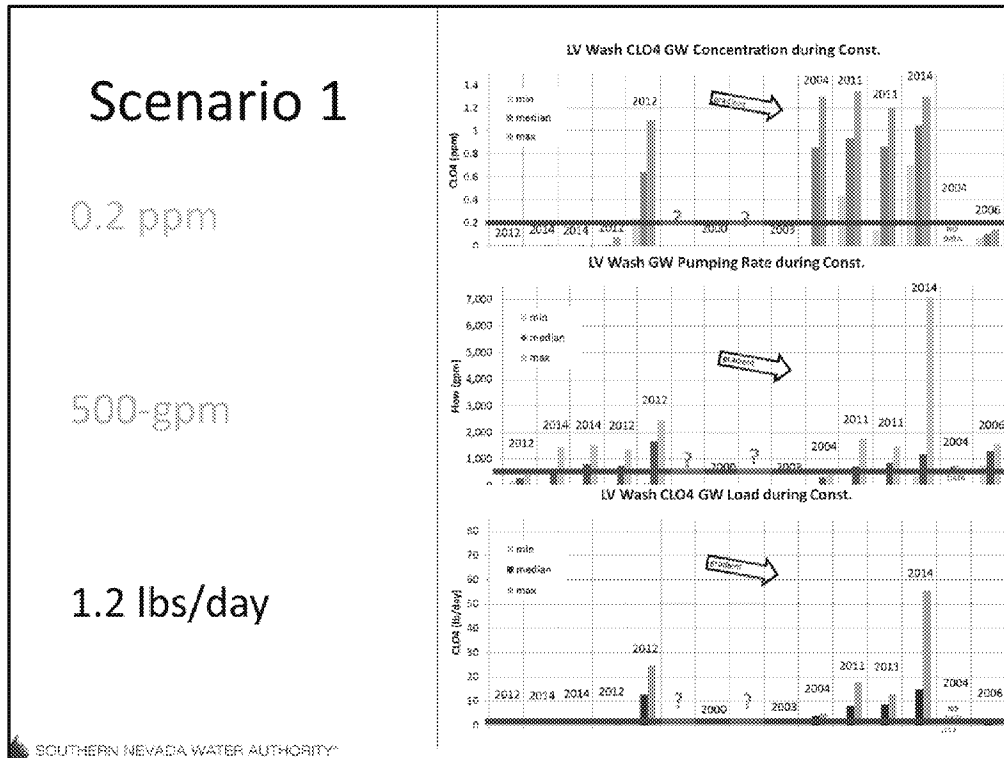
Additional DRAFT slides...

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Construction Factors

- Construction Schedule
 - Contract allows almost 800-days to construct Weirs
 - Contractor may scale back pumping, if necessary
- Contractor means and methods
 - Pumping rates? \Rightarrow ClO_4 loading
 - Duration of groundwater pumping?





Scenario 1:

CLO4 concentration:

0.2 ppm

GW pumping rate:

500-gpm

Corresponds to a CLO4 loading rate:

1.2-lb/day

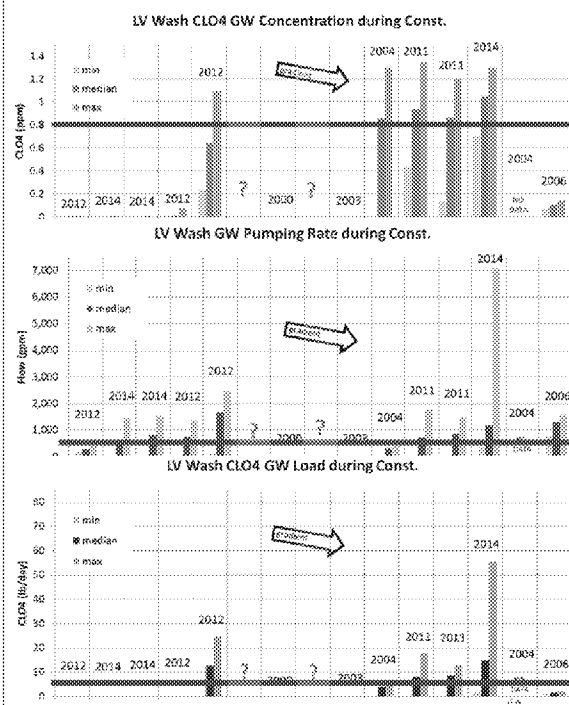
Scenario 2

0.8 ppm

500-gpm

4.8 lbs/day

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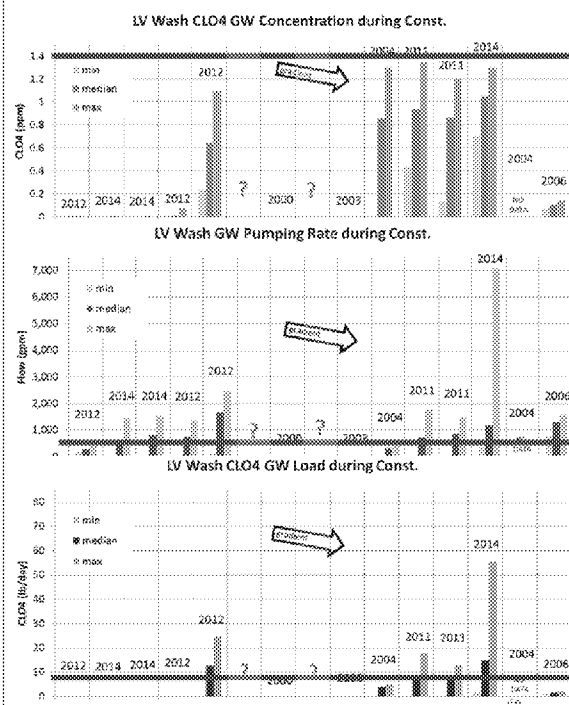
Scenario 3

1.4 ppm

500-gpm

8.4 lbs/day

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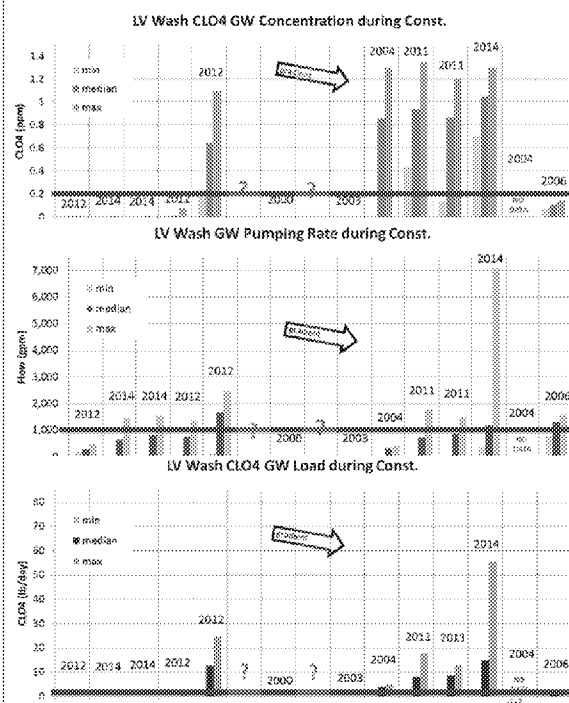


Scenario 4

0.2 ppm

1,000-gpm

2.4 lbs/day



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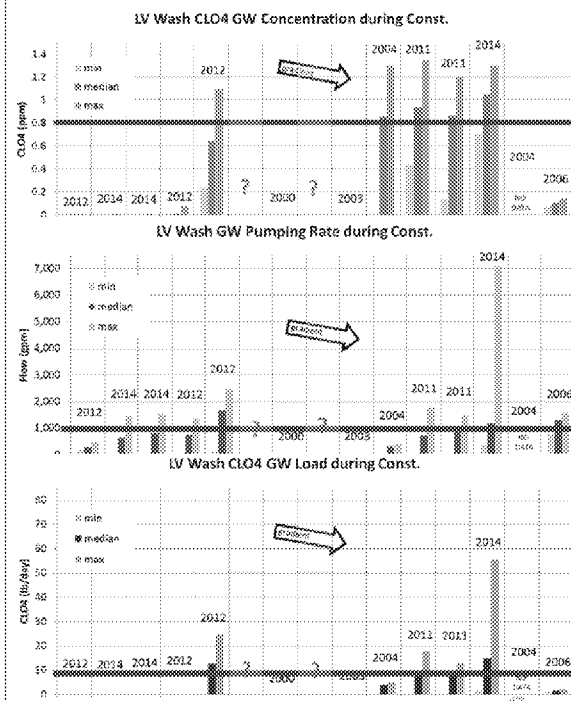
Scenario 5

0.8 ppm

1,000-gpm

9.6 lbs/day

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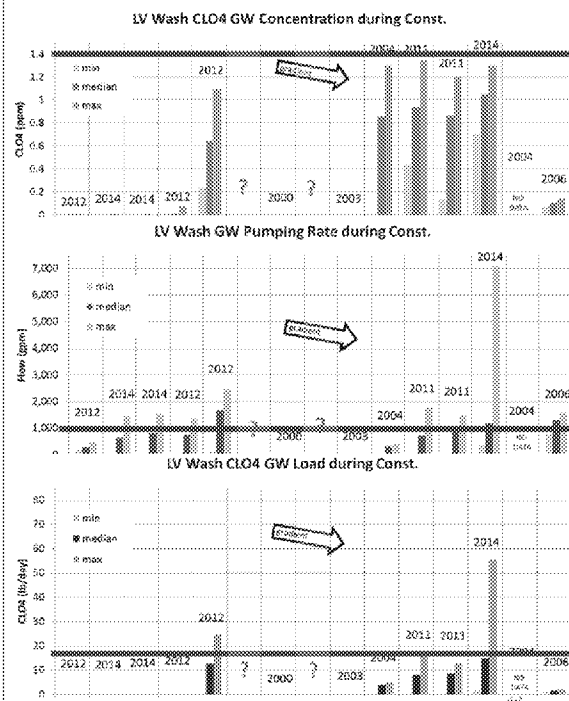
Scenario 6

1.4 ppm

1,000-gpm

16.8 lbs/day

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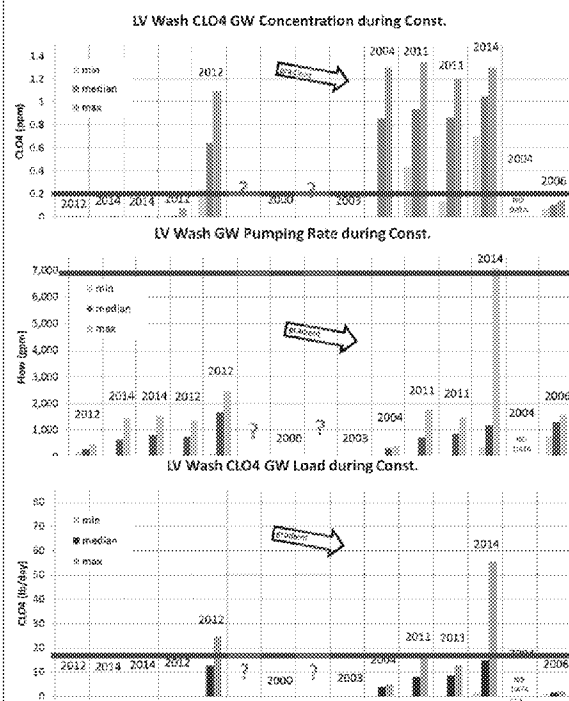
Scenario 7

0.2 ppm

6,900-gpm

16.6 lbs/day

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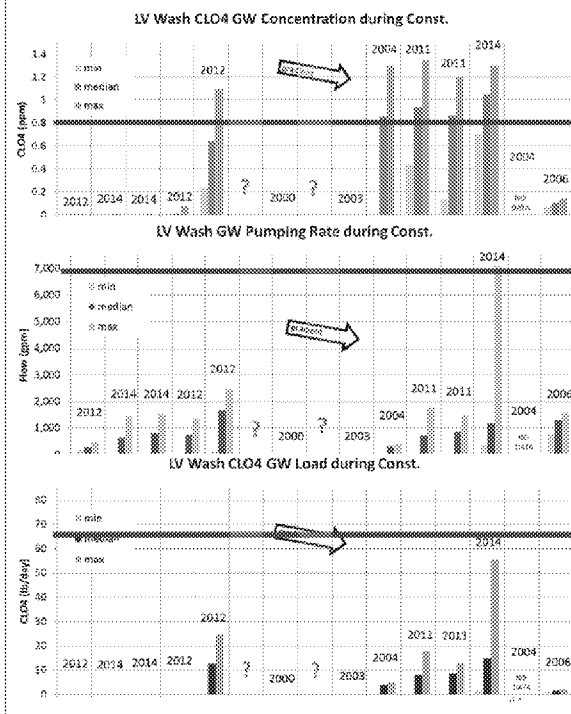
Scenario 8

0.8 ppm

6,900-gpm

66.3 lbs/day

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Scenario 9

1.4 ppm

6,900-gpm

116.0 lbs/day

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